

Chapter E2: Evaluation of Impingement and Entrainment in the South Atlantic Region

BACKGROUND: SOUTH ATLANTIC MARINE FISHERIES

Species of the family Sciaenidae, including Atlantic croaker, spot, red drum, black drum, weakfish, and spotted sea trout, contribute to some of the most important commercial and recreational fisheries in the South Atlantic region (NMFS, 1999b). The popularity of blackened redfish in U.S. restaurants beginning in the mid-1980's led to rapid increases in commercial landings of red drum, and eventual overexploitation of the offshore adult spawning stock. The Gulf of Mexico Fishery Management Council and The South Atlantic Fishery Management Council have now banned fishing red drum offshore until the adult stock recovers. There remains an inshore fishery for recreational anglers.

Atlantic menhaden is another important commercial and recreational species in Atlantic and Gulf of Mexico estuaries and coastal waters (NMFS, 1999b). In the Atlantic, the menhaden resource is fully utilized. Most menhaden harvest is for fish meal, fish oil, fish solubles, and bait fish. Menhaden is also an important forage species for marine birds and other fish species. Spawning stock biomass reached a peak in 1997, but the recruitment of juveniles in the past decade has reached historic lows. Another major management concern is overexploitation resulting from the harvesting too many fish before they reach adult size.

As in the Gulf of Mexico, important coastal pelagic species in the South Atlantic region include king and Spanish mackerels, cero, dolphinfish, and cobia (NMFS, 1999b). King and Spanish mackerel make up about 95 percent of the harvest of coastal pelagics. The east coast of Florida and the Florida keys is a major production area for the king mackerel commercial fishery.

Fisheries for snappers, groupers, amberjacks, grunts, seabasses, and other reef fishes are also important in the South Atlantic region (NMFS, 1999b). These fishes are vulnerable to overfishing because of their slow growth, delayed maturity, and ease of capture. Commercial quotas for snappers and groupers are in effect, as well as seasonal closures for some species.

Fisheries for invertebrate species such as shrimp, spiny lobster, and stone crab are also important in the South Atlantic region (NMFS, 1999b). The extensive shrimp fisheries are among the most valuable in the U.S.

CHAPTER CONTENTS

E2-1	Fishery Species Impinged and Entrained	E2-1
E2-2	EPA's Estimates of Current I&E in the South Atlantic Region Expressed as Age 1 Equivalents, Foregone Yield, and Production Foregone	E2-3
E2-3	Assumptions Used in Calculating Recreational and Commercial Losses	E2-4

E2-1 FISHERY SPECIES IMPINGED AND ENTRAINED

Table E2-1 shows the status of managed stocks in the South Atlantic region, indicating in bold the stocks subject to impingement and entrainment (I&E). Overfishing occurs when fishing mortality is above a management threshold, jeopardizing the long term capacity of the stock to produce the potential maximum sustainable yield on a continuing basis. A stock is considered overfished when biomass falls below a given threshold. In some cases, heavy fishing in the past may have reduced a stock to low abundance, so that it is now considered overfished even though the stock is not currently subject to overfishing.

As indicated in Table E2-1, 12 of the 32 managed stocks are classified as overfished, including vermilion snapper, red porgy, gag, red snapper, snowy grouper, warsaw grouper, golden tilefish, yellowtail snapper, red grouper, black grouper, black sea bass, and red drum. Other stocks are in the process of being rebuilt from levels below the maximum sustainable yield, including. The status of many other stocks is poorly known.

Table E2-1: Summary of Stock Status for Harvested Species of the South Atlantic Region Included in Federal Fishery Management Plans

Stock (species in bold are subject to I&E)	Overfishing? (fishing mortality above threshold)	Overfished? (biomass below threshold)	Approaching Overfished Condition?
Golden crab	No	Undefined	Unknown
White shrimp	No	Unknown	Unknown
Rock shrimp	No	Unknown	Unknown
Brown shrimp	No	Unknown	Unknown
Pink shrimp	No	Unknown	Unknown
Vermilion snapper	Yes	Yes	N/A
Red porgy	Yes	Yes	N/A
Gag	Yes	Yes	N/A
Red snapper	Yes	Yes	N/A
Snowy grouper	Yes	Yes	N/A
Warsaw grouper	Yes	Yes	N/A
Golden tilefish	Yes	Yes	N/A
Yellowtail snapper	Yes	Yes	N/A
Red grouper	Yes	Yes	N/A
Black grouper	Yes	Yes	N/A
Black sea bass	Yes	Yes	N/A
Goliath grouper (Jewfish)	No	Yes	N/A
Nassau grouper	No	Yes	N/A
Mutton snapper	No	No	No
Greater amberjack	No	No	No
Wreckfish	No	No	Unknown
Yellowedge grouper	No	No	Unknown
Red drum	Yes	Yes	N/A
Fire corals	No	Undefined	Unknown
Hydrocorals	No	Undefined	Unknown
Octocorals	No	Undefined	Unknown
Stony corals	No	Undefined	Unknown
Black corals	No	Undefined	Unknown
Spiny lobster	No	No	No
King mackerel	No	No	N/A
Spanish mackerel	No	No	No
Dolphin	No	No	No

E2-2 EPA'S ESTIMATES OF CURRENT I&E IN THE SOUTH ATLANTIC REGION EXPRESSED AS AGE 1 EQUIVALENTS, FOREGONE YIELD, AND PRODUCTION FOREGONE

Table E2-2 lists South Atlantic facilities in scope of the Phase II rule. Due to time, budget, and data limitations, EPA did not model I&E losses for the South Atlantic using the methods applied in the other regions. Rather, current loss and benefits estimates for the South Atlantic were extrapolated based on the total 3 year average operational intake flows at facilities in the Mid-Atlantic and Gulf of Mexico. The formula used is:

$$\text{South Atlantic losses} = (\text{Gulf} + \text{Mid-Atlantic losses}) * \text{South Atlantic flow} / (\text{Gulf} + \text{Mid-Atlantic flow}),$$

which is equivalent to

$$\text{South Atlantic losses} = (\text{Gulf} + \text{Mid-Atlantic losses}) * 0.178.$$

EPA applied this method *by species* to the estimated pounds of commercial and recreational harvest lost due to I&E (see Chapters E3 and E4). EPA only applied this method to the Mid-Atlantic and Gulf of Mexico regional totals for age 1 equivalents, total yield, and production foregone. The estimates are presented in Table E2-3.

**Table E2-2: South Atlantic Facilities in
Scope of the Section 316(b)
Phase II Rule**

In Scope Facilities
Brunswick Nuclear (NC)
Cape Canaveral (FL)
Henry D King (FL)
Indian River (FL)
Jefferies (SC)
Lauderdale (FL)
Mcmanus (GA)
Northside (FL)
Port Everglades (FL)
Riverside (GA)
Riviera (FL)
Southside (FL)
St Johns River Power (FL)
St Lucie Nuclear (FL)
Vero Beach (FL)
Williams (SC)

Table E2-3: Extrapolated Estimates of Current Annual I&E in the South Atlantic Region Expressed as Age 1 Equivalents, Foregone Fishery Yield, and Production Foregone

Loss Type	Age 1 Equivalents (millions)	Total Yield (million lbs)	Production Foregone (million lbs)
Impingement	58.2	12.4	5.3
Entrainment	206	11.1	4.8
Total	264	23.5	10.1

E2-3 ASSUMPTIONS USED IN CALCULATING RECREATIONAL AND COMMERCIAL LOSSES

As noted in the previous section, recreational and commercial I&E losses for the South Atlantic are estimated based on loss estimates for the Gulf of Mexico and Mid-Atlantic. Once these losses are estimated, the value of benefits is computed in a manner similar to the other regions. Table E2-4 presents the value per pound for commercially harvested species used in the commercial fishing analysis.

Age-1 equivalent fish that are spared from I&E are not necessarily old enough or large enough to be attractive to anglers. It may take one or more years for these fish to reach a harvestable age. For this reason, EPA discounts commercial and recreational benefits so that the cost and benefits estimates will be comparable. Tables E2-5 and E2-6 present the multiplicative discounting factors used in discounting benefits assuming a 3 percent real discount rate and a 7 percent real discount rate. For details on how these factors are developed, see Chapter A14.

Table E2-4: Commercial Value per Pound for Species Impinged and Entrained at South Atlantic Facilities

Species Group	Commercial Value per Pound (2002\$) ^a
Alewife	\$0.26
American shad	\$0.75
Atlantic croaker	\$0.33
Atlantic menhaden	\$0.04
Black drum	\$0.36
Blue crab	\$0.65
Mackerels	\$1.04
Other (commercial)	\$0.55
Pink shrimp	\$2.03
Sea basses	\$1.45
Sheepshead	\$0.67
Spot	\$0.39
Stone crab	\$1.34
Striped bass	\$1.27
Striped mullet	\$0.64
Summer flounder	\$1.70
Weakfish	\$0.55

^a Calculated using 1993-2001 commercial landings data from NMFS (2003a).

Table E2-5: Factors Applied to Recreational Benefits to Implement Discounting in the South Atlantic

Species Group	Discount Factors for Entrainment		Discount Factors for Impingement	
	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate
Atlantic croaker	0.934	0.858	0.962	0.918
Black drum	0.884	0.764	0.910	0.818
Mackerels	na	na	0.928	0.845
Other (rec. and com.)	0.922	0.831	0.950	0.889
Other (recreational)	0.922	0.831	0.950	0.889
Pinfish	0.960	0.911	0.989	0.975
Red drum	0.884	0.764	0.910	0.818
Sea basses	na	na	0.850	0.691
Searobins	0.912	0.813	0.940	0.870
Sheepshead	0.909	0.804	0.936	0.861
Silver perch	0.943	0.873	0.971	0.935
Spot	0.949	0.888	0.977	0.950
Spotted seatrout	0.936	0.863	0.965	0.923
Striped bass	0.864	0.717	0.879	0.749
Striped mullet	0.930	0.848	0.957	0.907
Summer flounder	na	na	0.941	0.874
Weakfish	0.950	0.890	0.979	0.953
Other (forage)	0.919	0.829	0.919	0.829

Table E2-6: Factors Applied to Commercial Benefits to Implement Discounting in the South Atlantic

Species Group	Discount Factors for Entrainment		Discount Factors for Impingement	
	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate
Alewife	0.872	0.730	0.898	0.782
American shad	0.867	0.723	0.893	0.773
Atlantic croaker	0.899	0.788	0.926	0.843
Atlantic menhaden	0.930	0.847	0.958	0.906
Black drum	0.788	0.592	0.811	0.633
Blue crab	0.949	0.888	0.978	0.950
Leatherjacket	0.933	0.854	0.961	0.914
Mackerels			0.918	0.826
Menhadens	0.913	0.813	0.940	0.870
Other (commercial)	0.913	0.813	0.940	0.870
Other (rec. and com.)	0.913	0.813	0.940	0.870
Pink shrimp	0.971	0.935	0.898	0.788
Sea basses			0.836	0.666
Sheepshead	0.907	0.800	0.934	0.856
Spot	0.921	0.831	0.949	0.889
Stone crab	0.944	0.877	0.972	0.938
Striped bass	0.841	0.675	0.848	0.692
Striped mullet	0.890	0.768	0.916	0.821
Summer flounder			0.890	0.773
Weakfish	0.924	0.836	0.951	0.895
White perch			0.883	0.756
Other (forage)	0.901	0.793	0.901	0.793